ACCESSION NR: AP4029698 S/0089/64/016/004/0354/0355

AUTHORS: Bogdanov, A. P.; Firsov, Ye. I.

TITLE: Gamma-radiation from the IRT-2000 reactor of the Belorussian Academy of Sciences

SOURCE: Atomnaya energiya, v. 16, no. 4, 1964, 354-355

TOPIC TAGS: radial channel, IRT 2000 reactor, gamma radiation, neutron beam, lead collimator, single crystal, electron photomultiplier, automatic recorder, spectrometer, tangential channel, half life period

ABSTRACT: The gamma-radiation spectrum emerging from the fuel core has been measured on a horizontal radial channel of an IRT-2000 reactor. A 20 cm-thick plug consisting of a paraffin and boron carbide mixture was used for filtering the neutron beam, and lead collimators were utilized for the formation of a gamma-radiation beam. A NaI (Tl) single crystal measuring 70x70 mm, combined with an electron photomultiplier, was employed as a spectrometer. An AI-100-1 multichannel analyzer was used for an amplitude analysis,

ACCESSION NR: AP4029698

the resulting data being recorded by an automatic device. The peaks discernible in the spectrum produced in the experiment corresponded to gamma-radiation with energies of 2.2 and 7.7 Mev. Similar methods have been used to investigate the spectrum of a residual gamma-radiation in an idle reactor after it was working for a long period of time at 1,000 kw capacity. The various spectra recorded over periods of 6, 20 and 70 hours following the stoppage of the reactor revealed gamma-radiations with energies ranging from 0.9 to 3 Mev. A further checkup on the behavior of the long-lived acitivity spectrum was impossible as it would have required the idling of the reactor for a lengthy period of time. Orig. art. has: 4 figures.

ASSOCIATION: None

SUBMITTED: 16Jul63 DATE ACQ: 01May64 ENCL: 00

SUB CODE: PH, NS NR REF SOV: 002 OTHER: 000

Card 2/2

BOGDANOV, A.P.; FIRSOV, Ye.I.

Use of a luminescent spectrometer in studying γ-rays from the (n, γ) reaction. Dokl. AN BSSR 8 no.6:376-378 Je '64. (MIRA 17:10)

1. Institut fiziki AN BSSR. Predstavleno akademikom AN BSSR B.I. Stapanovym.

RUDAK, E.A.; FIRSOV, Ye.I.

Determining the spin of the 0.416 Mev. level in the Fe^{55} nucleus from (d, p) and (n, γ) reactions. Dokl. AN BSSR 8 no.8:514-515 Ag '64. (MIRA 17:11)

1. Institut fiziki AN BSSR.

BOGDANOV, A.P.; FIRSOV, Ye.I.

Multichannel coincidence spectrométer on the basis of AI-100-1.
Prib. i tekh. eksp. 9 no.3:35-39 My-Je '64 (MIRA 18:1)

1. Institut fiziki AN BSSR.

APPROVED FOR RELEASE: 06/13/2000 CIA-RDP86-00513R000413220018-0"

Peb DIAAP

AP5009827 UR/0367/65/001/002/0235/0249

AUTHORS: Rudak, E. A.; Firsov, Ye. I.

19

...ray spectra from the (n,γ) reaction in Cr-50, Cr-52,

SOURCE. Yadernaya fizika, v. 1, no. 2, 1965, 235-249

TOPIC TAGS: gamma spectrum, neutron gamma reaction, chromium iso... neutron capture, gamma spectrometry, gamma transition

Spectra of gamma rays accompanying the capture of ther... from the IRT reactor of AN BSSR were investigated using ... MeV ... The sample was placed in an ... channel ... center of the reactor ... flux was ~10^{12} neut/cm^2 sec ... approx-

L 45192-65

ACCESSION NR: AP5009827

3

imately 50. The samples were separated Cr isotopes having ~70 g-barn for the product of the mass and the (n,γ) cross section. Energies and intensities of observed gamma rays from $Cr^{51,54,55}$ are tabulated ... with those obtained in preceding investigations. The ... chromium ... isotopes ... determined from the data in ... "We thank L. V. Groshev and A. M. Demidov for valuable suggestions and for direct experimental assistance." Orig. art. has: 9 figures and 3 tables.

ASSOCIATION: Institut fiziki Akademii nauk Belorusskoy SSR (Institute of Physics, Academy of Sciences Belorussian SSR)

...164 ENCL: 00 SUB CODE: NP

NO REF SOV: 005 OTHER: 031

L 4582-66 EWT(m)/EWP(t)/EWP(b)/EWA(h) IJP(c) JD

ACCESSION NR: AP5020257 UR/0367/65/002/001/0084/0091

AUTHOR: Loskutova, N. G.; Rudak, E. A.; Firsov, Ye. I.

29
28
B

TITLE: Gamma ray spectrum from the reaction $Fe^{54}(n, \gamma)Fe^{55}$ 19

SOURCE: Yadernaya fizika, v. 2, no. 1, 1965, 84-91

TOPIC TAGS: iron, gamma spectrum, gamma transition, radioactive decay scheme

ABSTRACT: The reaction was induced with thermal neutrons derived from the IRT reactor of AN BSSR and investigated with apparatus designed for investigating (n, γ) reactions in separated isotopes by the Institut fiziki (Institute of Physics) AN BSSR, consisting of a Compton magnetic γ spectrometer of 2% resolution and 0.3-Mev γ-ray threshold. The iron sample was enriched to 78.1% in Fe^{54}. The following γ-ray energies (in Mev) and intensities (% in parentheses) were observed: 9.31 (61), 8.98(12), 7.27(3.0) doublet, 6.82(2.0), 6.27(3.0), 5.75(2.5), 5.50(2.0), 5.37(1.3), 4.73(3.0) doublet, 4.55(1.4), 44.6(1.5), 4.17*(1.5), 3.79*(1.7), 3.38* (1.5), 3.07*(4.0) doublet, 2.90*(1.0), 2.67*(1.5), 2.63*(1.0), 2.47*(2.4), 2.05* (2.5), 1.92*(2.5), 1.63*(1.5), 1.5*(1.5), 1.32*(1.0), 1.24*(1.0), and the groups of lines at 0.93*(10.0) and 0.41*(29.0). Asterisk denotes γ rays observed for the first time). A scheme for the decay fo Fe^{55} from the capturing level is proposed

Card 1/3 09011007

L 4582-66

ACCESSION NR: AP5020257

on the basis of the data, and its main features are discussed. The level scheme is shown in Fig. 1 of the Enclosure. Orig. art. has: 4 figures and 2 tables.

ASSOCIATION: Institut fiziki Akademii nauk Belorusskoy SSR (Institute of Physics, Academy of Sciences, Belorussian SSR)

SUBMITTED: 13Nov64 ENCL: 01 SUB CODE: NP

NR REF SOV: 002 OTHER: 016

Card 2/3

L 4582-66

ACCESSION NR: AP5020257 ENCLOSURE: 01

O

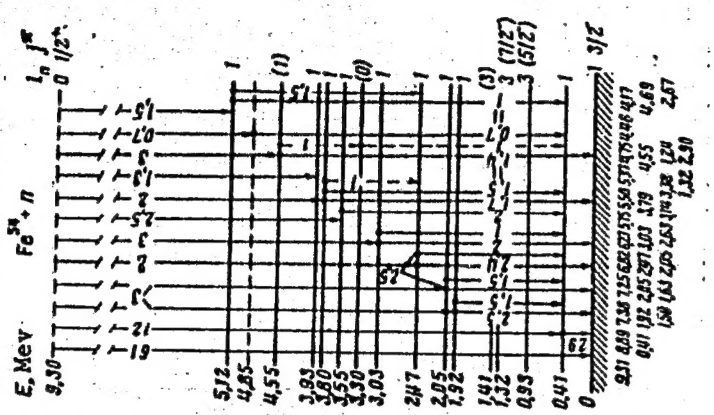

Fig. 1. Scheme of gamma transitions of Fe^{55} from the capture state

Card 3/3 DP

SOURCE: Atomnaya energiya, v. 18, no. 3, 1965, 285-287

TOPIC TAGS: gamma ray, isotope, spectroscopy, spectrometer

ABSTRACT: Studies of gamma emission in (n, gamma) reaction on various isotopes were [illegible] in a tangential reactor column using a Compton spectrometer [illegible] a [illegible] and measuring minimum of [illegible] graphite [illegible] placed opposite from the center of the [illegible] of thermal neutrons was about 3 x 10^{13} [illegible] beam of [illegible] was collimated by a system of lead collimators [illegible] from channel to the Compton spectrometer radiator. The distance between [illegible] spectrometer radiator was 4.5 cm. The [illegible] knocked [illegible] radiator within 1° from the incident beam were [illegible] magnetic [illegible] and momentum analyzed. Orig. art. has 4 figures.

Card 1/2

ACCESSION NR: AP5014018

ASSOCIATION: none

20Apr64

ENCL: 00

SUB CODE: NP, OP

OTHER: 000

Card 2/2

FIRSOV, Ye.I. [Firsau, IA.I.]; RUDAK, E.A.

Analysis of background conditions in the tangential channel of the reactor of the Radio Engineering Institute of the Academy of Sciences of the White Russian S.S.R. Vestsi AN BSSR. Ser.fiz.-mat.nav. no.1:73-76 '65.

Analysis of the spectra of separated isotopes from the (n, γ) reaction using the reactor of the Radio Engineering Institute of the Academy of Sciences of the White Russian S.S.R. Ibid.:77-79. (MIRA 19:1)

L 14006-66 EWT(m) DIAAP

ACC NR: AP6002469 SOURCE CODE: UR/0386/65/002/011/0522/0526

AUTHOR: Bogdanov, A. P.; Tadeush, V. N.; Firsov, Ye. I.

34
32
B

ORG: Institute of Physics, Academy of Sciences BSSR (Institut fiziki Akademii nauk BSSR)

TITLE: Determining the parameter for a mixture of M1- and E2-radiations for the 0.341 Mev transition in the Ti^{49} nucleus 19

SOURCE: Zhurnal eksperimental'noy i teoreticheskoy fiziki. Pis'ma v redaktsiyu. Prilozheniye, v. 2, no. 11, 1965, 522-526

TOPIC TAGS: titanium, gamma radiation, gamma transition, transition radiation

ABSTRACT: The authors attempt to resolve the contradictory data in the literature on the multiplicity of γ-radiation for the 0.341 Mev transition in the Ti^{49} nucleus. One source finds this transition to be a mixture of M1+E2 with a mixture parameter of -0.1 for +2.2. Another work finds evidence of a pure M1- transition. The authors irradiated a titanium target 8 mm in diameter and 2 mm thick with a collimated neutron beam with a flux of $4 \cdot 10^6$ neutrons/cm^2·sec. The γ-radiation detectors were two scintillation counters with thallium-activated sodium iodide crystals 70 mm in

Card 1/2

2

L 14006-66
ACC NR: AP6002469

2

diameter and 70 mm high. The resolving power of both spectrometers was 10% at a gamma energy of 661 kev. The coefficient A_2 is found to be -0.05 ± 0.010, which is somewhat lower than the theoretical value for a pure M1- transition (A_2 = -0.071). A curve is given showing the coefficient A_2 as a function of the mixture parameter for a mixture of M1 and E2 radiations in the first transition. This curve shows a mixed transition with a mixture parameter of -0.06 or +2.0. The authors are grateful to P. A. Krupchitskiy and G. A. Lobov who were responsible for the instigation of this experiment. Orig. art. has: 3 figures.

SUB CODE: 18/ SUBM DATE: 25Oct65/ ORIG REF: 001/ OTH REF: 005

Card 2/2 BC

BOGDANOV, A.P.; TADEUSH, V.N.; FIRSOV, Ye.I.

Determining the parameter of the mixed M1 and E2 radiations for the 0.341 Mev. transition in the Ti^{49} nucleus. Pis'. v red. Zhur. eksper. i teoret. fiz. 2 no. 11:522-526 D '65 (MIRA 19:1)

1. Institut fiziki AN BSSR. Submitted October 25, 1965.

S/048/62/026/008/022/028
B104/B102

AUTHORS: Firsov, Ye. P., Pivovarov, S. P., and Latyshev, G. D.

TITLE: Gradient meter based on a supergenerator controlled by nuclear precession

PERIODICAL: Akademiya nauk SSSR. Izvestiya. Seriya fizicheskaya, v. 26, no. 8, 1962, 1088-1090

TEXT: An apparatus for determining deviations of magnetic field strengths within the range 10^{-3} - 10^{-6} from the theoretical value is described. The apparatus (Fig. 1) works with a supergenerator (Fig. 2). The circuit of one supergenerator is attached to the magnetic surface, that of the other one is moved from point to point in the field. The difference of the supergenerator frequencies characterizes the homogeneity of the field, and is determined from the Lissajous figures on the oscilloscope. The distance between the pickups is $\sim$10 mm, the maximum inhomogeneity is $\leqslant 5 \cdot 10^{-3}$. There are 3 figures.

ASSOCIATION: Institut yadernoy fiziki Akademii nauk KazSSR (Institute of Nuclear Physics of the Academy of Sciences KazSSR)

Card 1/2

PIVOVAROV, S.P.; FIRSOV, Ye.P.; YASNILO, O.N.; LATYSHEV, G.D.

Comparison of circuits for paramagnetic resonance detection.
Trudy Inst. iad. fiz. AN Kazakh. SSR 6:119-123 '63.
(MIRA 16:10)

L 19576-63 EPF(c)/EWP(j)/EWT(l)/EWT(m)/BDS/EEC(b)-2 AFFTC/ASD/
IJP(C) Pc-4/Pr-4/Pi-4 GG/RM/WW/MAY/JFW

ACCESSION NR: AT3007856 S/2707/63/006/000/0124/0128

AUTHOR: Firsov, Ye. P.; Pivovarov, S. P.; Laty*shev, G. D.

TITLE: Simple magnetometer based on the principle of electron paramagnetic resonance

SOURCE: AN KazSSR. Institut yadernoy fiziki. Trudy, v. 6, 1963. Issledovaniya po fizike vysokikh energiy i elementarnykh chastits, 124-128

TOPIC TAGS: electron paramagnetic resonance magnetometer, magnetometer, diphenylpicrylhydrazyl, sodium ammonia solution, electron paramagnetic resonance, electron paramagnetic resonance signal, magnetic field measurement, electron paramagnetic resonance crystal, free radical paramagnetic resonance, free radical cyrstal, precision field meter, magnetic field meter

ABSTRACT: An instrument based on the EPR of free radicals for making precise measurements of magnetic fields of 70—800 oe with an accuracy of 0.1% is described in detail, and its performance

L 19576-63
ACCESSION NR: AT3007856

is investigated analytically. The device comprises a magnetic resonance pickup, a high-frequency generator, a modulator, a magnet, and an indicator. Diphenylpicrylhydrazyl crystals (line width of 2.7 oe) or a solution of sodium in ammonia (line width of 0.05 oe) are used as working substances. Analytical evaluations indicate that the output signal does not depend significantly on frequency within a wide frequency band. This makes the device particularly simple to operate. Orig. art. has: 4 figures, 10 formulas, and 1 table.

ASSOCIATION: none

SUBMITTED: 00 DATE ACQ: 08Aug63 ENCL: 00

SUB CODE: PH NO REF SOV: 002 OTHER: 000

FIRSOV, Ye. Ye.; ORLOV, V. M. (Engs.)

Steel, Structural

Crosscut drawn steel sheets, Stroi. prom. 31 No. 2, 1953.

9. Monthly List of Russian Accessions, Library of Congress, June 1953, Uncl.

USSR/Physics - Semiconductors conference FD - 3164

Card 1/4 FIRSAV Pub. 153 - 20/26

Author : Pikus, G. Ye.; Firsov, Yu. A.

Title : Conference on the theory of semiconductors

Periodical : Zhur. tekh. fiz., 25, No 13 (November), 1955, 2381-2394

Abstract : A conference on the theory of semiconductors, called by the Commission on Semiconductors in the Presidum of the Academy of Sciences USSR, was held in Leningrad from 4 to 8 February 1955. Participants were leading physicists and theoreticians of Moscow, Leningrad, Kiev, Sverdlovsk, Khar'kov, Chernovits and other cities, who are working the field of solid state physics. Academician A. F. Ioffe opened the conference with a report noting that a number of experimental facts contradict theory (e.g. various values of effective masses in their determination by different methods, anomalous temperature behavior of mobility and thermo-emf, etc.), that existing theory is actually inapplicable to many semiconductors (e.g. zone theory issuing from distant ordering is inapplicable to fluid and amorphous semiconductors, whose electrical properties do not differ from those of crystal semiconductors), that the existing theory of mobility is inapplicable to semiconductors with small mobility in which the free path length calculated from experimental data is less than the wavelength of electron and often even less than the lattice period, and that relations have yet to be found between the various properties of semiconductors (electric, magnetic, thermal, mechanical) and atomic characteristics. The conference

FD-3164

Card 2/4 Pub. 153 - 20/26

heard and discussed 12 reports on the following 9 most important divisions of semiconductor theory. I. Theory of polarons: S. I. Pekar, "Present status of semiconductor theory" (to be published in next issue). M. F. Deygen, "Theory of optical, magnetic and electric properties of metal-ammoniacal solutions." II. Polyelectron theory of semiconductors: S. V. Vonsovskiy, "Certain problems of the polyelectron quantum-mechanical theory of semiconductors" (to be published in ZhTF). Ye. P. Agafonova, "Accelerating action of external electric field on a system of interacting electrons in a crystal lattice" (she showed that in the polar model the accelerating action of field on a system in nonpolar state is practically absent in spite of nonzero probability of polarization of the system, i.e. in spite of probable formation of pairs and holes by the field; and that if the system has a finite number of pairs and holes then consideration of thermal motion of lattice gives an expression for electrical conductivity in weak field like that in the mono-electron theory). V. L. Bonch-Bruyevich, "Zone scheme of homeopolar crystal and oscillations of the crystal lattice." III. Magnetic properties of semiconductors: A. G. Samoylovich and L. L. Korenblit, "Certain problems of theory of magnetism of semiconductors." IV. Theory of excitons: A. I. Ansel'm and Yu. A. Firsov, "Length of free flight path of nonlocalized exciton in atomic and ionic crystals." V. Theory of mobility thermal and galvanomagnetic effects: T. A. Kontorova, "Theory of mobility of current carriers in atomic semiconductors." VI. Theory of fluid and amorphous semiconductors: A. I. Gubanov, "Zone theory of fluidity for close ordering" (the author solved the one-dimensional problem earlier, in ZhETF, 26 (2), 139, 1954). VII. Theory of radiatorless transitions: M. A. Krivoglaz, "Theory of thermal transitions." VIII. Theory of rectification: K. B. Tolpygo, "Distribution of concentrations

Card 3/4 Pub. 153 - 20/26

FD-3164

of carriers and ratio of electron and hole current." IX. Catalytic action of semiconductors: F. F. Vol'kenshteyn, "Mechanism of catalytic action of semiconductors" (the author expresses the assumption that electrons and holes on the surface of a semiconductor can play the role of free valences, and that the atoms and molecules adsorbed on the surface can capture these electrons).

In his concluding speech of the conference A. I. Ansel'm noted the following principal directions of the future development of solid-state theory: poly-electron theory of the solid state; application of general methods of quantum theory of the field to the problem of interaction of electrons with lattice oscillations; electrical and magnetic properties of crystals (theory of di-electric constant, diamagnetism, paramagnetism, and ferromagnetism of crys-tals); energy spectrum and mobility of current carriers in amorphous and fluid media; kinetic processes in semiconductors and metals (electrical con-ductivity, galvanomagnetic and thermomagnetic effects, influence of strong fields); theory of ion crystals (polar theory); theory of kinetic processes (electrical conductivity, galvanomagnetic and thermomagnetic effects) in semiconductors with small mobility where the concept of free path length loses sense; optical properties of electron crystals (internal photoeffect, absorption spectra, theory of the exciton); dynamics of crystal lattice (os-cillation spectra, heat capacity, heat conductivity); phase transitions in crystal lattices, the theory of defects and impurities in crystals; nonsta-tionary processes in a semiconductor (variable external fields), radiospec-troscopy of solids, and cyclotron effect: theory of rectification and

Card 4/4 Pub. 153 - 20/26 FD - 3164

amplification in semiconductors, and theory of semiconductor devices; the electronics of thermoelectronic emission, secondary electron emission, self-electron emission, external photoeffect of interaction of ions with the surface of the solid; theory of catalytic action of semiconductors.

Submitted : April 4, 1955

Firsov, Yu. A.

USSR/Solid State Physics - Solid State Theory. Geometric Cyrstallography, E-2

Abst Journal: Referat Zhur - Fizika, No 12, 1956, 34572

Author: Ansel'm, A. I., Firsov, Yu. A.

Institution: ~~None~~ Leningrad Physicotechnical inst., Academy of Sciences USSR

Title: Mean Free Path of Nonlocalized Exciton in an Atomic Crystal

Original Periodical: Zh. eksper. i teoret. fiziki, 1955, 28, No 2, 151-159

Abstract: The mean free path l of a nonlocalized exciton, due to its interaction with the acoustic (thermal) branch of the lattice vibration, is calculated. The wave function of the exciton is calculated in the effective-mass-method approximation. It is proposed that as the exciton absorbs and emits phonons, it does not become excited and it does not become disassociated. The processes of the vanishing of the nonlocalized exciton as a result of its localization and the recombination of the electron with the hole with a transformation of the excitation energy into heat and light are not considered. The analysis of the expression for l shows, that l of the exciton, like that of the electron (hole), is inversely proportional to the absolute temperature, but unlike the electron (hole) it depends on the energy. The character of this dependence is related to the ratio of the effective masses of the hole and of the electron and of the interaction constants.

1 of 1

Firsov, Yu. A.

USSR / Electricity

G

Abs Jour : Ref Zhur - Fizika, No 4, 1957, No 9677

Author : Ansel'm, A.I., Firsov, Yu.A.

Inst : Physico-Technical Institute, Academy of Sciences USSR, Leningrad

Title : Mean Free Path of Non-localized Excitaton in Polar Crystal

Orig Pub : Zh. eksperim. i teor. fiziki, 1956, 30, No 4, 719-723

Abstract : The author calculates the length of the mean free path of the non-localized exciton in a polar crystal, due to interaction with thermal oscillations of the lattice. The non-localized exciton is considered as a hydrogen-like formation of an electron and a hole.
Scattering of such an exciton is due to interaction between the electron and the hole with the longitudinal optical vibrations. An estimate shows that under ordinary conditions the probability of excitation or dissociation of the exciton

Card : 1/2

APPROVED FOR RELEASE: 06/13/2000 CIA-RDP86-00513R000413220018-0"

USSR / Electricity

G

Abs Jour : Ref Zhur - Fizika, No 4, 1957, No 9677

Abstract : upon collision is negligibly small. He therefore takes into account such collisions between the exciton and the photons, at which no dissociation or excitation of the exciton takes place. It is also proposed that the time of the mean free path of the exciton is much less than its lifetime.

Card : 2/2

FIRSOV, YU. A.

AUTHOR: Firsov, Yu. A. 57-1o-3/33

TITLE: Note on the Magnetic Susceptibility in Semiconductors of the Tellurium Type (Magnitnaya vospriimchivost' v poluprovodnikakh tipa tellura)

PERIODICAL: Zhurnal Tekhn. Fiz., 1957, Vol. 27, Nr 1o, pp. 2212-2228 (USSR)

ABSTRACT: With reference to the publication of the author in ZhETF, 32,(6), 135o, 1957, the magnetic properties of the identical semiconductors are investigated under the same assumptions on the position of the extremal values. J.M. Luttinger showed (Phys.Rev.,1o2, 1o3o,1956) in the quantum theory of cyclotrone resistance,that in the case of a meeting of the zones the energetic spectrum of the current carriers in a magnetic field for small quantum numbers N cannot be determined according to the quasi-classical method, which considers carriers of different type (for ex. the two types of holes in p-germanium) independently. Therefore here the order of magnitude of the share of these small values of the quantum numbers in the sum $Z(T) = \sum_{N=0}^{\infty} e^{-\frac{E(N)}{kT}}$ is investigated. It is shown, that the magnetic susceptibility cannot be computed from the sum of the magnetic susceptibilities of the carriers

Card 1/3

belonging to these colliding zones, for the case of the zone collision point. Carriers of different type cannot be considered to be independent and the transitions between the colliding zones cannot be neglected. If this circumstance is taken into consideration leads already in the case of weak fields ($\frac{H}{kT} \ll 1$) to the fact, that additional terms appear in the formula for the magnetic susceptibility, which may even lead to an inversion of sign. The investigation of the dependency of the magnetic susceptibility χ on the angle in the case of strong fields enables to draw a number of conclusions on the zonal texture. If χ is symmetrical with respect to rotations of $2\pi/3$ around the z-axis (z- axis along the screw axis of third order), the zones can collide or not, the extremal values, however, lie in the points of the T- type (three ellipsoides) or of the N-type (6 ellipsoids). If χ is axially symmetrical with respect to rotations around the z- axis, then either no collision takes place and the extremal value (E(k) lies in the centre of the first zone of Brillouin or a collision between zones exists, but either of the parameters A_1 and A equals zero. There are 4 fig-

Note on the Magnetic Susceptibility in Semiconductors of the Tellurium Type 57-10-3/33

ures and 3 Slavic references.

ASSOCIATION: Institute for Semiconductors AN USSR, Leningrad (Institut poluprovodnikov AN SSSR, Leningrad)

SUBMITTED: March 21, 1957

AVAILABLE: Library of Congress

Card 3/3

FIRSOV, Yu. A.

AUTHOR: FIRSOV,Yu.A. 56-6-13/56

TITLE: On the Structure of Electron Spectra of Tellurium Type Lattices. (O strukture elektronnogo spektra v reshetkakh tipa tellura, Russian)

PERIODICAL: Zhurnal Eksperim. i Teoret. Fiziki, 1957, Vol 32, Nr 6, pp 1350-1367 (U.S.S.R.)

ABSTRACT: By means of the group theory the general energy spectrum of a surplus electron in a tellurium-like crystal lattice was theoretically computed. It was shown that in various directions of the "k"-space the formation of zones is possible. The influence exercised by spin interaction is investigated.
Semiconductors of this crystal structure have two carriers of the same sign. (With 4 Tables, 3 Illustrations, and 4 Slavic References).

ASSOCIATION: Not given

PRESENTED BY:

SUBMITTED: 29.4.1956

AVAILABLE: Library of Congress

Card 1/1

FIRSOV, Yu. A., Cand Phys-Math Sci -- (diss) "Effect of Complex Zonal Structure on the Galvano-Magnetic and Optical Properties of Semi-Conductors." Len, 1958. 14 pp (Acad Sci USSR. Len Phys-Tech Inst), 100 copies. Bibliography at the end of the text (15 titles). (KL 40-58, 112)

5

AUTHOR: Firsov, Yu. A.

57-28-6-1/34

TITLE: The Value of the Hall (Kholl) Constant in Semiconductors in Strong Magnetic Fields (Znacheniye postoyannoy Kholla v poluprovodnikakh pri sil'nykh magnitnykh polyakh)

PERIODICAL: Zhurnal Tekhnicheskoy Fiziki, 1958, Vol. 28, Nr 6, pp. 1129-1139 (USSR)

ABSTRACT: Knowledge of the zonal structure of semiconductors is of essential importance in order to be able to understand the physical processes taking place in them. The numerical calculations of the energetic spectrum can, however, not claim to be of great accuracy. For this reason it is useful to be able to form an opinion of the properties of the zonal structure from such experiments in which it does not appear to be of essential importance to know the mechanism of dispersion on lattice vibrations or additions. Besides, by cyclotron-resonance, this demand is satisfied by the measuring tests of the Hall constant in very strong

Card 1/5

magnetic fields, if the magnetic field itself is $\frac{uH}{c} \gg 1$ and forms the basic factor for the limitation of the magnitude of the current. Non-trivial angle-dependences of the Hall constant (Kholl) can be observed at $\frac{H}{kT} \gtrsim 1$. It is true, however, that in this case the equation by Boltzmann (Bol'tsman) and the classical distribution function cannot be applied, because here the wavelength of the electron can be compared and is even greater than the radius of its effective range in the magnetic field. Therefore the problem must be solved by means of the statistical density matrix. In the present case, the problem was solved by taking the quantization of the motions of electrons in the magnetic field into account. The author also investigated several extreme values in the energetic spectrum. In the course of the investigation of the angle dependence of the Hall constant (Kholl) it is possible to ascertain whether the zones touch. In this case the angle dependences cannot be described by the

The Value of the Hall (Kholl) Constant in Semiconductors in Strong Magnetic Fields

57-28-6-1/34

formulae (20)

$$\frac{1}{R} = ecg_H \sum_{l=1}^{N} \int_{-\infty}^{\infty} dp_z \sum_{n=0}^{\infty} f^0 \left(\frac{\mathcal{E}_n^l - \xi}{kT} \right) = -ec \frac{\partial \Omega}{\partial \xi}$$

(27)

$$n^1(H) = n_o \left[\frac{1}{N} \sum_{l=1}^{N} \frac{\hbar \omega_l \lambda}{2 \mathrm{sh} \left\{ \frac{\hbar \omega_l \lambda}{2} \right\}} \right]$$

(28a)

$$n^{(2)}(H) = n_o \mathrm{ch} \left\{ \frac{\mu_B H}{kT} \right\} \left[\frac{1}{N} \sum_{l=1}^{N} \frac{\hbar \omega_l \lambda}{2\ \mathrm{sh} \left\{ \frac{\hbar \omega_l \lambda}{2} \right\}} \right]$$

For individual ellipsoids in the space k it is possible to find all components of the tensor of the effective mass and to determine the relative distribution of the extreme values. The results obtained have the correctness of the zonal theory because they are not based upon any

Card 3/5

considerations concerning the interaction mechanism of the electrons and lattice vibrations. The author thanks Professor A. I. Ansel'm and L. I. Korovin for the interest they displayed.

Appendix: The method of the "effective mass" in the presence of electric and magnetic fields. The problem concerning the motion of electrons in magnetic field in the case of touching zones was solved by Luttinger and Kohn (reference 7), who also formulated the problem of the slowly changing electric field. With respect to $A_1(r)$ and $A_2(r)$ (1 and 2 are indices of the zones touching each other) the following system of equations is obtained:

$$\left\{ \left| \begin{matrix} D_{11}^{\alpha\beta} \hat{\Pi}_\alpha \hat{\Pi}_\beta - E, & D_{12}^{\alpha\beta} \hat{\Pi}_\alpha \hat{\Pi}_\beta \\ D_{21}^{\alpha\beta} \hat{\Pi}_\alpha \hat{\Pi}_\beta & D_{22}^{\alpha\beta} \hat{\Pi}_\alpha \hat{\Pi}_\beta - E \end{matrix} \right| - e\vec{\mathcal{E}} \left\| \begin{matrix} \vec{r} & 0 \\ 0 & \vec{r} \end{matrix} \right\| \right\} \begin{pmatrix} A_1(\vec{r}) \\ A_2(\vec{r}) \end{pmatrix} = 0$$

The Value of the Hall (Kholl) Constant in Semiconductors in Strong Magnetic Fields

57-28-6-1/34

There are 7 references, 6 of which are Soviet.

ASSOCIATION: Institut poluprovodnikov AN SSSR, Leningrad (Leningrad Institute of Semiconductors AS, USSR)

SUBMITTED: July 5, 1957

1. Semiconductors—Structural analysis 2. Semiconductors—Magnetic factors 3. Magnetic fields—Properties 4. Electrons—Motion 5. Mathematics

Card 5/5

KOROVIN, L.I.; FIRSOV, Yu.A.

Structure of the hole zone tellurium. Zhur. tekh. fiz. 28 no.11:2417-2427 N '58. (MIRA 12:1)
(Tellurium)

FIRSOV YU. A.

AUTHOR: Firsov, Yu. A. 56-1-43/56

TITLE: A Correction to the Article "On the Problem of the Structure of the Electron Spectrum in Tellurium Type Lattices" (Popravka k stat'ye "K voprosu o strukture elektronnogo spektra v reshetkakh tipa tellura")

PERIODICAL: Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, 1958, Vol. 34, Nr 1, pp. 240-242 (USSR)

ABSTRACT: At first reference is made to a conclusion erroneously made in an earlier work by the author (reference 1). The equation replacing this erroneous conclusion is given; it indicates the absence of an additional collision of the zones due to an inversion with respect to time. A diagram illustrates the distribution of the terms. This figure contains 2 points with the inclination zero. But additional points with the inclination zero which are connected with the concrete form of the potential $U(\vec{r})$ are also possible. Then the author gives some corrections to the above-mentioned earlier work. Apart from these corrections all results of the above-mentioned paper remain valid. As far as the valence zone is concerned, the degeneration vanishes most probably in a

Card 1/2

A Correction to the Article "On the Problem of the Structure of the Electron Spectrum in Tellurium Type Lattices" 56-1-43/56

point (given in the figure) due to the spin-orbit interaction. For the conduction electrons the assumption of the intensive spin orbit splitting is not necessary. E. I. Rashbu called the author's attention to the incorrect conclusions mentioned here. There are 1 figure and 3 references, 2 of which are Slavic.

ASSOCIATION: Institute for Semiconductors AN USSR (Institut poluprovodnikov Akademii nauk SSSR)

SUBMITTED: October 1o, 1957

AVAILABLE: Library of Congress

Card 2/2

FIRSOV, Yu.A.

Cyclotron resonance in semiconductors with complex equipotential surfaces. Fiz.tver.tela 1 no.1:44-61 Ja '59. (MIRA 12:4)
(Silicon--Electric properties) (Germanium--Electric properties)
(Diamagnetism)

FIRSOV, Yu.A.

Remarks concerning the article "Cycletron resonance in semiconducters with complex equipotential surfaces." Fiz. tver. tela 1 no.3:528 Mr '59. (MIRA 12:5)

(Semiconducters)

89215

S/056/61/040/001/021/037
B102/B212

24.7700 (1043,1143,1144,1395)

AUTHORS: Gurevich, V. L., Firsov, Yu. A.

TITLE: Theory of electrical conductivity of semiconductors in a magnetic field. I

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 40, no. 1, 1961, 199-213

TEXT: A study has been made of the effect of inelasticity of electron scattering on kinetic phenomena in a semiconductor in a strong magnetic field. A strong field is such where the diagonal tensor component of the transversal conductivity is small compared with the off-diagonal component ($\sigma_{xx}/\sigma_{xy} \ll 1$). The authors have restricted their studies to the Boltzmann statistics and are considering two characteristic cases: 1) The little inelastic scattering by acoustic phonons which results in a small effect only; and 2) scattering by polarized optical oscillations, when consideration of inelasticity has an influence on all characteristic relations. The

Card 1/4

89215

S/056/61/040/001/021/037
B102/B212

Theory of electrical conductivity...

authors proceed from a formula by Kubo (Ref. 3) which expresses σ_{xx} in terms of velocity operators of the center of mass of the Landau oscillator, i.e., in terms of a Green function for an electron in a magnetic field. This method permits very general calculations, e. g., to consider Coulomb interaction of electrons. The range of strong fields has a classical range, where $\alpha = \hbar\Omega/2kT \ll 1$ (Ω is the Larmor frequency and T is the temperature), and a quantum range, where $\alpha \gtrsim 1$. The quantum theory is applied in both ranges. A formula is first derived where conductivity is expressed in terms of an integral of the retarded two-particle Green function for the electron system in a magnetic field; that is in Born approximation with respect to electron interaction with scatterers. The formula is investigated for a case where electrons obey the Boltzmann statistics, and where their mutual Coulomb interaction is negligible. Results obtained by Kubo's formula for the classical range of the field strength are compared with values calculated with the help of the equation of motion. It is found that, practically, an equation of motion can be used over the total classical range with a collision operator independent of the magnetic field strength. The authors also present a solution of the equation of motion in the magnetic field for

Card 2/4

09215

S/056/61/040/001/021/037
B102/B212

Theory of electrical conductivity...

electron scattering by optical phonons at low temperatures. For this case the function $\sigma_{xx}(H)$ was found to consist of two horizontal and two parts with a steep slope. The quantum corrections to σ_{xx} in the classical range have also been calculated. It was found that these can oscillate in the case of scattering by optical phonons and always pass through a maximum if the limiting frequency ω_0 of the optical oscillations amounts to a multiple of the Larmor frequency. These oscillations differ from all other known types of oscillations of statistical conductivity because they appear when applying the Boltzmann statistics. When scattering by acoustic and optical phonons for the case $\Omega \gg \omega_0$, was considered, $\sigma_{xx}(H)$ functions were found in the quantum region which agreed with those found by Adams and Holstein after excluding the logarithmic factors. For the case $\omega_0 \gg \Omega$ a non-monotonic oscillation of $\sigma_{xx}(H)$ was found. Like in the classical region σ_{xx} passes through maxima if $\omega_0 = n\Omega$; the quantum corrections were relatively small in the classical range but quite considerable in the quantum region.

Card 3/4

89215

These resonance oscillations of the conductivity, predicted by theory, which are periodic in 1/H and are due to electron scattering on optical phonons, might be observed in germanium-type atomic semiconductors. The authors thank A. I. Ansel'm for discussions; B. I. Davydov, I. M. Shmushkevich, M. A. Krivoglaz, S. I. Pekar, A. I. Larkin, Yu. B. Kumer, V. L. Bonch-Bruyevich, A. G. Mironov, V. G. Skobov, O. V. Konstantinov, V. I. Perel' and M. I. Klinger are mentioned. There are 14 references: 10 Soviet-bloc and 4 non-Soviet-bloc.

ASSOCIATION: Institut poluprovodnikov Akademii nauk SSSR (Institute of Semiconductors, Academy of Sciences USSR)

SUBMITTED: July 8, 1960

APPROVED FOR RELEASE: 06/13/2000 CIA-RDP86-00513R000413220018-0"

22131
S/056/61/040/003/011/031
B102/B205

24.1200 1158, 1160, 1395

AUTHORS: Gurevich, V. L., Skobov, V. G., Firsov, Yu. A.

TITLE: Giant quantum oscillations of sound absorption by metals in a magnetic field

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 40, no. 3, 1961, 786-791

TEXT: A theoretical study has been made of low-temperature sound absorption by metals placed in a magnetic field. Supposing that $\hbar\Omega \gg kT$ (Ω - Larmor frequency of electrons), that the mean free path of conduction electrons is very large compared to the sonic wavelength, and that the latter is large compared to the Larmor radius of conduction electrons, sound absorption can be regarded as a direct absorption of phonons by metal electrons. In the absence of a magnetic field, those electrons will play the principal role in absorption, whose velocity component $v_{\varkappa}$ in the direction of the wave vector $\vec{\varkappa}$ of sound waves is equal to the phase velocity w_p of sound. This case has already been studied by A.I.Akhiyezer,

Card 1/7 6

22131

S/056/61/040/003/011/031
B102/B205

Giant quantum oscillations...

M. I. Kaganov, and G. Ya. Lyubarskiy (ZhETF, 32, 837, 1957), and the present authors adopted a similar procedure. For the sake of simplicity, an isotropic quadratic dispersion law is assumed to hold for electrons; so, the electron energy in the magnetic field is given by $\varepsilon_n = \hbar\Omega(n+1/2) + p_z^2/2m$, where n indicates the oscillator quantum number according to Landau, $\Omega = eH/mc$ the Larmor frequency, m the effective mass, and p_z the projection of the quasi-momentum on the direction of the field $\vec{H}$ ($\equiv$ z-axis). Taking into account the theorems of conservation of energy and quasi-momentum, and $\varepsilon_{n'}(p_z+\hbar\varkappa_z) = \varepsilon_{n'}(p_z)' + \hbar v_z\varkappa_z$, one obtains the condition $\Omega(n'-n) + w_p\varkappa = v_z\varkappa_z$ (5). If the magnetic field is strong enough and, thus, $\Omega > \varkappa_z v_F$ (v_F - Fermi velocity), then condition (5) will be satisfied only with $n = n'$. Then, the quasi-momentum of electrons participating in sound absorption is equal to $p_z^o = mw_p/\cos\vartheta$, where ϑ symbolizes the angle between the vectors $\vec{\varkappa}$ and $\vec{H}$. However, if $w_p \ll v_F$, then those electrons will make the greatest contribution to sound

Card 2/4

22131

 S/056/61/040/003/011/031
B102/B205

absorption, for which $p_z \ll p_F$. On the other hand, only those electrons participate in absorption, the energies of which belong to a blurred Fermi distribution. The quasi-momenta corresponding to these energies are shown in the attached figure. $\varepsilon_n(p_z)$ are parabolas cutting the band of width kT. Its center line forms the level of the chemical potential ζ. The band width is smaller than the distance between the parabolas, in accordance with the condition $\hbar\Omega \gg kT$. The projections of the sections on the abscissa indicate the intervals of allowed and forbidden p_z values. The width of the intervals diminishes as one approaches p_F. Their position depends on $\vec{H}$. If $\vec{H}$ is such that p_z^0 is in the interval of allowed p_z values, a particularly strong sound absorption will occur. The occurrence of giant oscillations of the coefficient of sound absorption is determined by the condition $\zeta \gg \hbar\Omega \gg kT$. This case is now investigated in greater detail. The contribution to absorption by transverse electric fields produced by deformation of the conductor by sound waves is neglected, and elastic electron scattering is assumed.

$$\Gamma = \frac{\pi}{V_0 \rho u_0^2 w} \sum_{\alpha\alpha'} \frac{\partial F_\alpha}{\partial \zeta} \langle \alpha | U | \alpha' \rangle |^2 \delta(\omega_{\alpha\alpha'} + \omega). \qquad (14)$$

is obtained for the coefficient of sound absorption. Here, ϱ is the density of the crystal, u_0 the sound-wave amplitude, w the group velocity of sound, V_0 the volume of sound, $\langle\alpha|U|\alpha'\rangle$ a matrix element of the operator U ($U = \Lambda_{ik} u_{ik} \cdot e^{i\vec{\varkappa}\vec{r}}$; u_{ik} = amplitude of the deformation tensor in the sound wave; Λ_{ik} = tensor related to the quasi-momentum); the subscripts α and α' indicate the state of the free electron in the magnetic field; $\hbar\omega_{\alpha\alpha'} = \varepsilon_\alpha - \varepsilon_{\alpha'}$. In the simplest case where the components of Λ_{ik} are constant, the electron spectrum is quadratic and isotropic, and $\vec{\varkappa}$ and $\vec{H}$ are parallel, one has

$$\Gamma = \Gamma_0 \frac{\hbar\Omega}{8kT} \frac{\varkappa}{m} \sum_{n, s_z} \int dp_z \delta\left(\frac{\varkappa p_z}{m} + \frac{\hbar\varkappa^2}{2m} - \omega\right) \times$$
$$\times \operatorname{ch}^{-2}\left[\frac{\zeta - \hbar\Omega(n + 1/2) - \mu_0 s_z H - p_z^2/2m}{2kT}\right], \qquad (16)$$

where μ_0 is the Bohr magneton. $\Gamma_0 = m^2|\Lambda_{ik} n_{ik}|^2/2\pi\hbar^2 \varrho n_0^2 \varkappa\omega$ is the

Card 4/7 6

coefficient of sound absorption at $H = 0$. Integration with respect to p_z yields

$$\Gamma = \Gamma_0 \frac{\hbar\Omega}{8kT} \sum_{n, s_z} \mathrm{ch}^{-2}\left[\frac{\hbar\Omega(n+1/2)+s_z\mu_0 H-\zeta}{2kT}\right]. \quad (18)$$

If $\hbar\Omega \ll kT$ and summation is performed over n, one obtains $\Gamma = (\Gamma_0/2)\int_0^\infty \frac{dy}{\mathrm{ch}^2(y-\zeta/2kT)} \approx \Gamma_0$. Finally, the experimentally interesting case $\hbar\varkappa^2/2m \ll \nu$; $\omega \ll \nu$ is discussed. Here, the δ-function can be replaced by $\nu/\pi[\nu^2 + (\hbar\varkappa p_z/m)^2]$, and by proceeding to the dimensionless integration variable y one obtains

$$\Gamma = \Gamma_0 \frac{\hbar\Omega}{2kT}\int dy \frac{1}{\pi}\frac{B}{1+B^2y^2}\sum_{n,s_z}\frac{1}{4}\mathrm{ch}^{-2}\left(\frac{y-A_n}{2}\right). \quad (22)$$

$y = p_z(2mkT)^{-1/2}$; $B = (2kT/m)^{1/2}\varkappa/\nu$; $A_n = [\zeta-\hbar\Omega(n+\frac{1}{2})-s_z\mu_0 H]/kT$. In the case of giant oscillation, the ratio between the maximum and the minimum absorption coefficients is given by $\Gamma_{max}/\Gamma_{min} \sim \varkappa l(\hbar\Omega/\zeta)^{1/2}\hbar\Omega/kT \gg 1$ (25). It is noted that classical computations are only possible if $\hbar\Omega \ll kT$; if

Card 5/46

22131
S/056/61/040/003/011/031
B102/B205

Giant quantum oscillations...

$\hbar\Omega \gg kT$, sound absorption in a magnetic field must be treated in a quantum-theoretical manner. There are 1 figure and 4 Soviet-bloc references.

ASSOCIATION: Leningradskiy fiziko-tekhnicheskiy institut Akademii nauk SSSR (Leningrad Institute of Physics and Technology, Academy of Sciences USSR); Institut poluprovodnikov Akademii nauk SSSR (Institute of Semiconductors, Academy of Sciences USSR)

SUBMITTED: July 25, 1960 (initially), November 24, 1960 (after revision)

Card 6/7 6

27196

24.7700

S/056/61/041/002/018/028
B111/B212

AUTHORS: Firsov, Yu. A., Gurevich, V. L.

TITLE: Theory of the electrical conductivity of semiconductors in a magnetic field. II

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 41, no. 2, 1961, 512-523

X

TEXT: In (Ref. 1: ZhETF, 40, 199, 1961) V. L. Gurevich and Yu. A. Firsov obtained an expression for the diagonal elements of the tensor (σ_{xx}) of transverse conductivity in semiconductors located in a strong magnetic field. Electron interaction was neglected. The present paper deals with the influence of this interaction on the conductivity for the case of an isotropic and quadratic electron spectrum. For systems with electron-electron interaction, σ_{xx} will be equal to zero, but it will differ from zero if there are interactions with other scatterers, e.g., phonons. The electron energy is calculated by quantum-mechanical methods and specialized for the case of Boltzmann statistics and a quadratic and

Card 1/3

27196

Theory of the electrical... S/056/61/041/002/018/028
B111/B212

isotropic spectrum. Electron-phonon interaction and consequently, scattering probability are found to increase abruptly if the phonon frequency is close to the eigenfrequency of the electron system. The authors construct precise theory, based on Kubo's formula for σ_{xx} (Ref. 4, see below) and σ_{xx} is expanded in a power series of the electron-phonon interaction. An exact formula is derived for σ_{xx}, and some graphs are discussed. The expression is examined for the case where the electrons obey a Boltzmann statistics and their scattering can be described in the Born approximation. As an example, the amplitude height of resonance conductivity oscillations is computed. A. I. Larkin (ZhETF, 37, 264, 1959), O. V. Konstantinov, V. I. Perel' (ZhETF, 39, 197, 1960), M. Born, Huang K'un (Dinamicheskaya teoriya kristallicheskikh reshetok - Dynamic theory of crystal lattices, IIL, 1958, chapter II, § 8) are mentioned. There are 1 figure and 11 references: 7 Soviet and 4 non-Soviet. The three most important references to English-language publications read as follows: Ref. 4: R. Kubo, J. Phys. Soc., Japan, 12, 570, 1957; Ref. 8: E. N. Adams, T. D. Holstein, J. Phys. Chem. Solids, 10, 254, 1959; Ref. 2: S. Doniach, Proc. Phys. Soc., 73, 849, 1959.

Card 2/3

27196

Theory of the electrical... S/056/61/041/002/018/028
B111/B212

ASSOCIATION: Institut poluprovodnikov Akademii nauk SSSR (Institute of Semiconductors of the Academy of Sciences USSR)

SUBMITTED: March 6, 1961 (initially)
May 16, 1961 (after revision)

Card 3/3

28930
S/056/61/041/004/014/019
B111/B112

24.2120(1049,1141,1160)

AUTHORS: Gurevich, V. L., Firsov, Yu. A.

TITLE: Theory of plasma diffusion in a magnetic field

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 41, no. 4, 1961, 1151 - 1167

TEXT: The transverse diffusion coefficient for particles in completely ionized plasma is determined by employing a graph technique. The Born parameter is assumed to be small, the magnetic field is assumed to be strong, and the Larmor frequency of electrons is assumed to be much higher than their collision frequency. The role of electrons and ions in the screening of the electron-ion interaction, the deformation of Debye clouds, and the inelastic scattering of electrons and ions are taken into account. The corrections to the diffusion coefficient for the effect of the magnetic field on electron-ion collisions are estimated. The case is studied, where the Debye radius is smaller than the Larmor radius of electrons but larger than the Larmor radius of ions, and where the magnetic field affects the collisions considerably. The general expression for the

Card 1/5

electronic conductivity σ_{xx}^{ee} in the x-direction can be expanded in a series of $1/\Omega\tau$ (Ω denotes the Larmor frequency, τ the electron relaxation time). σ_{xx}^{ee} is calculated by the graph technique of O. V. Konstantinov and V. I. Perel' (Refs. 2 and 3: ZhETF, 39, 197, 1960), which is described here again. A formula for the overall contribution to the conductivity obtained by calculating the normalized electron-electron interaction is presented. The general expression for σ_{xx}^{ee} is given by

$$D_{xx}^{ee} = \frac{n}{8\pi^2}\left(\frac{c}{eH}\right)^2 \int d^3q\, q_y^2 \left(\frac{4\pi e^2}{q^2}\right)^2 \int_{-\infty}^{\infty} d\omega \frac{F_q^i(\omega) F_q^e(\omega)}{A^2(\omega, q) + B^2(\omega, q)} \equiv$$

$$\equiv [ne^4/\pi\sqrt{2}m^{1/2}(kT)^{1/2}\Omega^2]\,\mathcal{J}, \qquad (33)$$

$$A(\omega, q) = 1 + \varkappa^2 q^{-2}\,[\mathrm{Re}\, P_q^e(\omega) + \mathrm{Re}\, P_q^i(\omega)], \qquad (34)$$

$$B(\omega, q) = \varkappa^2 q^{-2}\,[\mathrm{Im}\, P_q^e(\omega) + \mathrm{Im}\, P_q^i(\omega)]. \qquad (35)$$

Card 2/5

28930

Theory of plasma diffusion in ...

S/056/61/041/004/014/019
B111/B112

where $D^{ee}_{xx} = \sigma^{ee}_{xx}/ne^2\beta$, and

$$F^e_q(\omega) = \hbar\beta \frac{\mathrm{Im}\, P^e_q(\omega)}{2\pi\, \mathrm{sh}(\hbar\omega\beta/2)} = \frac{1}{nV_0} e^{\hbar\omega\beta/2} \sum_{\lambda\lambda'} |\langle\lambda| e^{iqr} |\lambda'\rangle|^2 n_\lambda \delta(\omega - \omega_{\lambda\lambda'}) \quad (31)$$

and

$$P^e_q(\omega) = \frac{2}{\hbar\beta}\int_0^\infty dt\, e^{-i\omega t} \sin\left(\frac{\hbar q_z^2}{2m} t + \frac{\hbar q_\perp^2}{2m\Omega}\sin\Omega t\right) \times$$
$$\times \exp\left(-\frac{q_z^2}{2m\beta} t^2 - \frac{\hbar q_\perp^2}{m\Omega}\, \mathrm{cth}\frac{\hbar\Omega\beta}{2} \sin^2\frac{\Omega t}{2}\right). \quad (28)$$

The general formulas are simplified for $\varkappa R \gg 1$, $q_z \gg 1/R$, where $R = v_T/\Omega$.

$$D_{xx} = \frac{2}{3}\left(\frac{2\pi m}{kT}\right)^{1/2}\left(\frac{c}{eH}\right)^2 ne^4 \left\{\ln\frac{1}{2eC_1\xi^2} - \frac{1}{\sqrt{\pi}}\int_0^\infty e^{-x^2}\ln[a^2(x)+b^2(x)]\,dx - \right.$$
$$\left. - \frac{2}{\sqrt{\pi}}\int_0^\infty \left[\frac{a(x)}{b(x)}\,\mathrm{arctg}\frac{b(x)}{a(x)} - 1\right] e^{-x^2}dx\right\}, \quad (43)$$

holds theoretically for D_{xx}, where C = 0.577. However, the true expression is

Card 3/5

4

$D_{xx} = \frac{2}{3} \cdot \left(\frac{2\pi m}{kT} \right)^{1/2} \cdot \left(\frac{c}{eH} \right)^2 \cdot ne^4 \cdot \ln(0.55\, q_T^2/\varkappa^2 \cdot \mathcal{J}$ at $1 \gg \varkappa R \gg 1/\mu$ and $1/\mu^2 \gtrsim q_o R$ (q_o - characteristic cut-off momentum) is given by $\mathcal{J} = \frac{8\pi^{3/2}}{3} \ln(q_T R) + 4\pi^{3/2} \ln\left(\frac{1}{\varkappa R}\right) \ln \mu$. The only difference between this expression and that of S. T. Belyayev (Ref. 15: Fizika plazmy i problema upravlyayemykh termoyadernykh reaktsiy, 3, Izd. AN SSSR, 1958, str. 66) is that q_T is replaced by kT/c^2. This might mean that the small size of the Born parameter is only necessary for collisions with large momentum transfer, whereas in the case of small momentum transfers the contribution does not depend on - whether or not Born approximation is applied. The authors thank V. I. Perel'. V. G. Skobov (Ref. 12: ZhETF, 37, 1457, 1959; 38, 1304, 1960), L. D. Landau (Ref. 1: ZhETF, 7, 203, 1937) and O. V. Konstantinov, V. I. Perel' (Ref. 2: ZhETF, 39, 861, 1960) are mentioned. There are 10 figures and 15 references: 11 Soviet and 4 non-Soviet. The three most recent references to English-language publications read as follows: H. Brooks, Phys. Rev., 83, 879, 1951.

4f

Card 4/5

28930
S/056/61/041/004/014/019
B111/B112

Theory of plasma diffusion in ...

R. Kubo, J. Phys. Soc. Japan, 12, 570, 1957. E. N. Adams, T. D. Holstein, J. Phys. Chem. Solids, 10, 254, 1959.

ASSOCIATION: Institut poluprovodnikov Akademii nauk SSSR (Institute of Semiconductors of the Academy of Sciences USSR)

SUBMITTED: April 1, 1961

4

Card 5/5

33356
S/181/62/004/001/029/052
B123/B104

24,2140 (1072, 1147, 1164)

AUTHORS: Gurevich, V. L., Larkin, A. I., and Firsov, Yu. A.

TITLE: Possibility of semiconductor superconductivity

PERIODICAL: Fizika tverdogo tela, v. 4, no. 1, 1962, 185 - 190

TEXT: The authors discuss the possibility of a transition of a semiconductor into the superconducting state. Such a transition is found to be impossible in nonpolar semiconductors at a carrier concentration $n \ll 10^{19}$ since due to the low electron state density near the Fermi surface phonon attraction between the electrons is weaker than their Coulomb repulsion. Transition in polar, nonpiezoelectric semiconductors is possible only if the Fermi energy is much higher than the limit frequencies of the longitudinal optical vibrations. The authors obtained conditions for bringing about this transition which are the more favorable the more strongly the electron and lattice vibrations are coupled. These conditions are defined for InSb-type piezoelectric semiconductors with a nonpiezoelectric semiconductor being considered first. The results hold both for conduction electrons and donors, and for holes and acceptors. X

Card 1/3

33356

S/181/62/004/001/029/052

Possibility of semiconductor... B123/B104

The authors mention Abrikosov who studied the superconductivity of metals with high electron gas density, and N. N. Bogolyubov et al. who made calculations for metals (Novyy metod v teorii sverkhprovodimosti, izd. AN SSSR, 1958). The authors first consider a model with isotropic effective mass. They derive an equation for calculating the energy gap

$$\Delta(\omega) = -\frac{ia}{\pi}\iint\left(1-\frac{\varepsilon_\infty}{\varepsilon_c}\frac{\omega_l^2}{\omega_l^2-(\omega-\omega_1)^2}\right)\frac{\Delta(\omega_1)\,d\zeta_1\,d(\hbar\omega_1)}{(\hbar\omega_1)^2-\xi_1^2-\Delta^2-i\delta}. \quad (12)$$

X

$$a = \frac{e^2}{4\pi\hbar v_F\varepsilon_\infty}\ln\frac{p_F^2}{\hbar^2\varkappa^2}; \quad (13).$$

v_F = electron velocity at Fermi surface, ε_∞, ε_c = dielectric constants, $\xi^2 = (p - p_F)^2 v_F^2$, ω_l = frequency of longitudinal optical phonons, ζ-Fermi energy. For other denotations c.f. G. M. Eliashberg, ZhETF, 38, 966, 1960. It can be seen that the maximum gap width corresponds to the minimum velocity at the Fermi surface, i. e., to the maximum effective mass.

Card 2/3

33356

Possibility of semiconductor...

S/181/62/004/001/029/052
B123/B104

These formulas obtained for the model with isotropic effective mass also hold for the anisotropic case up to and including one numerical factor under the natural logarithm. In piezoelectric semiconductors the attractive force between the electrons contributes to the exchange of piezoacoustic phonons. Superconductivity can be the most favorably studied in those polar semiconductors in which the electrons in the conduction band are sufficiently concentrated and in which they are strongly coupled with the lattice vibrations. There are 1 figure and 4 references: 3 Soviet and 1 non-Soviet. The reference to the English-language publication reads as follows: J. Bardeen, L. Cooper, J. Schrieffer. Phys. Rev., 108, 1175, 1957.

ASSOCIATION: Institut poluprovodnikov AN SSSR Leningrad (Institute of Semiconductors AS USSR, Leningrad)

X

SUBMITTED: July 24, 1961

Card 3/3

34242
S/181/62/004/002/036/051
B102/B138

24,7700 (1035,1043,1055,1144)

AUTHORS: Gurevich, V. L., and Firsov, Yu. A.

TITLE: Theory of the entrainment of electrons by phonons in semiconductors of the rhombohedral system

PERIODICAL: Fizika tverdogo tela, v. 4, no. 2, 1962, 530-537

TEXT: When phonons of non-equilibrium distribution (due to a temperature gradient), collide with conduction electrons, the resulting electron flow causes a current. This effect of electron entrainment by phonons was first investigated by L. E. Gurevich (ZhETF, 16, 193, 1946), and the theory has been developed by C. Herring. The theoretical considerations of the present paper relate to the experiments carried out by I. N. Timchenko and S. S. Shalyt (FTT, 1961) with p-type tellurium. The order of magnitude and the temperature dependence of the thermo-emf are determined for various directions of temperature gradient to the crystal axis. The carrier concentration is assumed to be so low that the effect of the electrons on the non-equilibrium phonons is negligible. The problem consists of two parts: 1) Solution of the kinetic equation for

X

Card 1/5

the phonons which gives the non-equilibrium addition to the phonon distribution function; 2) Solution of the electron kinetic equation a "force" proportional to this addition acts upon the electron. It is shown that if the isoenergetic surface of the carriers is in crystal symmetry, the estimate gives almost the same as would result from the isotropic spectrum. The hole spectrum of tellurium has these properties and consists; as L. I. Korovin and Yu. A. Firsov (ZhTF, 28, 11, 2417, 1958) have shown, of one or two ellipsoids of revolution with centers on the third order axis. The main role in the entrainment is that of the acoustic phonons of the branch with maximum frequency $\omega(\vec{q})$. For a rhombohedral crystal of class D_3 and $T \ll \theta$, the relaxation time of longitudinal phonons contacting the vibrational branches is given by

$$\tau_1(q) = f^{-1}(\vartheta, \varphi)\frac{a_0}{w}\left(\frac{q_T}{q}\right)^3, \qquad (13)$$

X

$$q_T = \left(\frac{Mw^2}{kT}\right)^{1/2}\left(\frac{\theta}{T}\right)\frac{k\theta}{\hbar w},$$

and when they join it,

$$\tau_2 = f_2^{-1}(\vartheta, \varphi)\frac{a_0}{w}\left(\frac{q_p}{q}\right)^3, \quad q_p = \frac{k\theta}{\hbar w}\left(\frac{\theta}{T}\frac{Mw^2}{kT}\right)^{1/5}, \qquad (14).$$

M - mass of the crystal unit cell, w - mean sonic velocity, a_0 - lattice constant, θ - Debye temperature, $f_{1,2}(\vartheta, \varphi)$ are dimensionless functions of the angles, which tend to zero as ϑ^2 if $\vartheta \to 0$. ϑ is the angle between $\vec{q}$ and the z-axis which coincides with one of the second-order axis. In these two cases

$$\alpha_{zz}^{(1)} = \frac{\eta_{zz}^{(1)}}{\sigma_{zz}} \simeq \frac{k}{e}\frac{a_0 E_0}{\hbar w}\frac{Mw^2}{kT}\left(\frac{\theta}{T}\right)^2\left(\frac{k\theta}{\hbar w}\right)^2\frac{E_0 \bar{m}^2}{\hbar s (mkT)^{1/2}} \sim \frac{1}{T^{7/2}}, \qquad (15a)$$

$$\alpha_{zz}^{(2)} = \frac{\eta_{zz}^{(2)}}{\sigma_{zz}} \simeq \frac{k}{e}\frac{a_0 E_0}{\hbar w}\frac{Mw^2}{kT}\frac{\theta}{T}\frac{\bar{m} E_0}{\rho kT}\left(\frac{k\theta}{\hbar w}\right)^3 \sim \frac{1}{T^3}. \qquad (15b)$$

Card 3/5

hold. σ_{xx} is the component of the conductivity tensor, η_{xx} is given by

$$\eta_{xx} = \frac{neE_0^2 l}{kT^2 \rho} \int_{\Omega} d^3q\, q \sin^2\theta\, g_s(\theta, \varphi)\, \tau(q). \qquad (5).$$

ρ is the crystal density and n the electron concentration, E_0 is the constant of the deformation potential. Some of the other characteristics of the phonon spectrum are also discussed. S. S. Shalyt and I. N. Timchenko are thanked for discussions. L. D. Landau and Ye. M. Lifshits (Mekhanika sploshnykh sred - Continuum mechanics - GITTL , 195) are mentioned. There are 2 figures and 12 references: 9 Soviet and 3 non-Soviet. The three references to English-language publications read as follows: C. Herring. Phys. Rev. 95, 954, 1954; 96, 1163, 1954; H. J. Fan, R. S. Caldwell. Phys. Rev. 94, 1427, 1954; Reports on Progress in Phys. XIX, 107, 1956.

X

34242

Theory of the entrainment of electrons ... S/181/62/004/002/036/051
B102/B138

ASSOCIATION: Institut poluprovodnikov AN SSSR Leningrad (Institute of Semiconductors of the AS USSR, Leningrad)

SUBMITTED: October 7, 1961

X

Card 5/5

37935

24.6111
24.7700

S/181/62/004/005/026/055
B125/B108

AUTHORS: Gurevich, V. L., Lang, I. G., and Firsov, Yu. A.

TITLE: The role of optical phonons in infrared absorption by free carriers in semiconductors

PERIODICAL: Fizika tverdogo tela, v. 4, no. 5, 1962, 1252-1262

TEXT: This is a study of infrared absorption by free carriers in semiconducting cubic crystals. The damping (caused by the anharmonic lattice forces) of the optical vibrations ($\gamma \ll \omega$) does not depend on electron concentration. In the case of weak interaction between electrons and optical vibrations, the dielectric constant $\varepsilon(\omega) = \varepsilon_L(\omega)+\varepsilon_e(\omega)$ consists of the lattice part ε_L and the electron part $\varepsilon_e=4\pi i\sigma(\omega)/\omega=a_e(\omega)+ib_e(\omega)$. For $\omega\tau\ll 1$, σ is virtually independent of ω and equal to its statistical value. τ is the characteristic relaxation time. $a_e(\omega)=-4\pi ne^2/m\omega^2$ holds in the case of a square-law isotropic dispersion. The expressions

f

Card 1/5

S/181/62/004/005/026/055
The role of optical phonons in infrared... B125/B108

$$\mathrm{Re}\,\sigma = \frac{2ne^2a}{3m\omega_l}\left(\frac{\omega_l}{\omega}\right)^{3/2} F\left(\frac{\hbar\omega}{2kT}, \frac{\hbar\omega_l}{2kT}\right), \quad (17)$$

$$F(x, y) = \sqrt{\frac{2}{\pi}}\, x^{-1/2} \frac{\mathrm{sh}\,x}{\mathrm{sh}\,y}\left[|x-y|\,K_1(|x-y|) + (x+y)\,K_1(x+y)\right] \quad (18)$$

hold in the case of Boltzmann statistics where $K_1(z)$ is the MacDonald function of first order. In the limiting cases where $\hbar(\omega-\omega_1)/kT \gg 1$, $\hbar|\omega-\omega_1|/kT \ll 1$, and $\hbar(\omega_1-\omega) \gg kT$ at sufficiently low temperatures, Eq. (17) assumes the forms

$$\boxed{\mathrm{Re}\,\sigma = \left(\frac{2ne^2a}{3m\omega_l}\right)\left(\frac{\omega_l}{\omega}\right)^{3/2}\left(1-\frac{\omega_l}{\omega}\right)^{1/2}} \quad (19)$$

$$\boxed{\mathrm{Re}\,\sigma = \left(\frac{2ne^2a}{3m\omega_l}\right)\left(\frac{2}{\sqrt{\pi}}\right)\left(\frac{\hbar\omega_l}{kT}\right)^{-1/2}} \quad (20)$$

and

Card 2/5

$$\mathrm{Re}\,\sigma = \frac{2n^2 a}{3m\omega_l}\left(\frac{\omega_l}{\omega}\right)^{1/2}\left(\frac{\omega_l}{\omega}-1\right)^{1/2}\exp\left[-\frac{\hbar(\omega_l-\omega)}{kT}\right], \tag{21}$$

respectively. Re $\sigma(\omega)$ increases rapidly at frequencies $\hbar|\omega-\omega_l|/kT \sim 1$ because of the threshold production of optical phonons. The dissipation of energy described by Re $\sigma(\omega)$ is caused by second-order effects.

$$\mathrm{Re}\,\varepsilon(\omega) = \varepsilon_\infty\left[\frac{(\omega_l^2-\omega^2)(\omega_t^2-\omega^2)}{(\omega_t^2-\omega^2)^2+\omega^2\gamma^2} - \frac{\omega_p^2}{\omega^2}\right], \tag{22}$$

For $\omega < \omega_t$, the experimental absorption coefficient increases with frequency. For $\hbar\omega_l/kT \gg 1$, absorption decreases exponentially with decreasing temperature. In the case of Fermi statistics at T=0,

$$\mathrm{Re}\,\sigma = \frac{a}{3\pi^2 2^{1/2}}\frac{e^2 m^{1/2}\omega_l^{1/2}}{\hbar^{1/2}}\left(\frac{\zeta}{\hbar\omega}\right)^2\left(\frac{\omega_l}{\omega}\right)f\left(\frac{\hbar\omega}{\zeta}\right), \tag{23}$$

with

$$\left.\begin{aligned}
&f(x)=0 \qquad (\text{при } x<0);\\
&f(x)=2(\sqrt{1+x}-\sqrt{1-x})+x(\sqrt{1+x}+\sqrt{1-x})-\\
&-\left(\frac{x^2}{4}\right)\ln\frac{\left[\left(1-\frac{x}{2}\right)-\sqrt{1-x}\right]\left[\left(1+\frac{x}{2}\right)+\sqrt{1+x}\right]}{\left[\left(1+\frac{x}{2}\right)-\sqrt{1+x}\right]\left[\left(1-\frac{x}{2}\right)+\sqrt{1-x}\right]} \quad (\text{при } 0<x\leqslant 1);
\end{aligned}\right\} \tag{24}$$

$$\left.\begin{aligned}
&f(x)=(2+x)\sqrt{1+x}-\left(\frac{x^2}{4}\right)\ln\frac{1+\frac{x}{2}+\sqrt{1+x}}{1+\frac{x}{2}-\sqrt{1+x}} \quad (\text{при } x\geqslant 1);\\
&x=\frac{\hbar(\omega-\omega_l)}{\zeta}.
\end{aligned}\right\} \tag{25}$$

is valid when $\hbar\omega_1/kT \gg 1$, $\hbar|\omega - \omega_1|/kT \gg 1$ and $p_F^2/2m \gg kT$. p_F is the Fermi momentum. There are 4 figures. The most important English-language reference is: R. Newman. Phys. Rev., 111, 1518, 1958.

Card 4/5

The role of optical phonons in infrared S/181/62/004/005/026/055
B125/B108

ASSOCIATION: Institut poluprovodnikov AN SSSR Leningrad (Institute of Semiconductors AS USSR, Leningrad)

SUBMITTED: January 2, 1962

Card 5/5

GUREVICH, V.L.; FIRSOV, Yu.A.; EFROS, A.L.

New type of magnetoresistance oscillations in semidonductors and semimetals. Fiz.tver.tela 4 no.7:1813-1819 Jl '62. (MIRA 16:6)

1. Institut poluprovodnikovAN SSSR, Leningrad.
(Magnetoresistance) (Semiconductors--Electric properties)

FIRSOV, Yu.A.

Theory of the Hall effect in low-mobility semiconductors. Fiz. tver tela 5 no.8:2149-2169 Ag '63. (MIRA 16:9)

1. Institut poluprovodnikov AN SSSR, Leningrad.
(Hall effect) (Semiconductors)

LANG, I.G.; FIRSOV, Yu.A.

Mobility of polarons of small radius at low temperatures. Fiz. tver. tela 5 no.10:2799-2817 O '63. (MIRA 16:11)

1. Institut poluprovodnikov AN SSSR, Leningrad.

43374

S/056/62/043/005/038/058
B102/B104

24 7700

AUTHORS: Lang, I. G., Firsov, Yu. A.

TITLE: Kinetic theory of semiconductors with low mobility

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 43, no. 5(11), 1962, 1843 - 1860

TEXT: A certain type of semiconductors is characterized by very low carrier mobility ($u \ll 1\ cm^2/v\cdot sec$) and, at $T \gtrsim T_{Debye}$, by a typical temperature dependence: $u \sim \exp(-E_a/kT)$, where E_a is the activation energy (cf. Phys. Rev. 112, 1861, 1958; J. Chem. Phys. 26, 582, 1957). This u(T) dependence of the low-mobility semiconductors can be explained only by assuming multiphonon scattering when strong interaction exists between carriers and lattice vibrations. At $T < T_{Debye}$ the carriers are nonlocalized polarons with small radius. There exists a temperature range where the indeterminacy of the polaron energy exceeds the polaron band width ($\hbar W_{k} \gtrsim \Delta E_p$) where the superbarrier jumps contribute only little to the con-

Card 1/3

ductivity. The kinetic theory for this range, and for higher temperatures ($T > T_{Debye}$) where classical superbarrier jumps of the carriers from site to site are the main mechanism, is derived and discussed in great detail. The time between these site-to-site jumps Δt is less than the characteristic time t_p of tunnel transitions but much greater than the collision-induced time t_0 of jumps:

$$t_p \gg \Delta t \gg t_0, \quad t_0 < \omega_0^{-1}, \quad \Delta t \gg \omega_0^{-1},$$

$$t_p = \frac{\hbar}{\Delta E_p} \sim \frac{\hbar}{J} e^{S_T}, \quad t_0 \sim \frac{\hbar}{(E_a kT)^{1/2}}, \quad \Delta t \approx \frac{1}{W_H} = \frac{\hbar^2}{J^2 t_0} e^{E_a/kT} \quad (40)$$

ω_0 is the frequency of longitudinal optical phonons, J is the width of the conduction band. In addition the inequalities

$$\eta_1 = J^2/(E_a kT)^{1/2} \hbar\omega_0 \ll 1, \quad \text{т. е.} \ t_p > (t_0/\omega_0)^{1/2} \quad (41)$$

will be valid, demanding a narrow conduction (or valence) band. This is the case e.g. for NiO-type semiconductors. The electrical conductivity

due to the above mentioned jumps will be proportional to $\exp(-E_a/kT)$ also in a wider temperature range if $\tau_2 \sim T^{-1/2}$. For the polaron-phonon scattering a transfer equation is derived by which various kinetic coefficients can be calculated. There are 3 figures. The most important English-language references are: I. Yamashita, T. Kurosawa, J. Chem. Phys. Solids, 5, 34, 1958; J. Phys. Soc. Japan, 15, 802, 1960; R. Kubo, J. Phys. Soc. Japan, 12, 570, 1957; G. H. Wannier, Phys. Rev. 52, 191, 1937.

ASSOCIATION: Institut poluprovodnikov Akademii nauk SSSR (Institute of Semiconductors of the Academy of Sciences USSR)

SUBMITTED: June 6, 1962

LANG, I.G.; FIRSOV, ~~Yu.A.~~

Mobility of small-radius polarons at low temperatures. Zhur. eksp. i teor. fiz. 45 no.2:378-380 Ag '63. (MIRA 16:9)

1. Institut poluprovodnikov AN SSSR.

(Polarization (Nuclear physics))

GUREVICH, V. L.; PARFENYEV, R. V.; FIRSOV, Yu. A.; SHALYT, S. S.

"The investigation of a new type oscillations in the magneto-resistance." [sic]

report submitted for Intl Conf on Physics of Semiconductors, Paris, 19-24 Jul 64.

L 4021-65 EWT(1)/EWG(k)/T/EWA(h) Peb IJP(c)/SSD/ FWL/ ... /ESD(gs)/

ACCESSION NR: AP4043652 S/0056/64/047/002/0734/0743

AUTHOR: Gurevich, V. L.; Firsov, Yu. A.

B

TITLE: New type of oscillations of longitudinal magnetic resistance of semiconductors 21

SOURCE: Zh. eksper. i teor. fiz., v. 47, no. 8, 1964, 734-743

TOPIC TAGS: magnetic resistance, semiconductor, electron phonon interaction, elastic scattering, oscillation

ABSTRACT: Transverse oscillations were predicted theoretically by the authors (ZhETF v. 40, 199, 1961 and v. 41, 512, 1961) and observed experimentally by S. M. Puri and T. H. Geballe (Bull. Am. Phys. Soc. v. 8, no. 4, 1963, 309). In this article the authors develop a theory for the oscillations of the longitudinal magnetic resistance, caused by resonant scattering of electrons by optical ... a strong magnetic field ...

Card 1/3

NR: AP4043652

relaxation time of the conduction ... An at-
made to interpret the ...

... res stance. The ...
... and their spin is ... are
...
less probable than scattering without spin ... The re-
also be different in semiconductors with ... impurity
where elastic scattering by the impurities predominates
... by acoustic phonons ...
for reviewing the manuscript and for many valuable remarks,
and R. V. Parfen'yev for great help in preparing the manuscript
for publication. Orig. art. has: 1 figure and 31 formulas.

Card 2/3

L 14031-65
ACCESSION NR: AP4043652

ASSOCIATION: Institut poluprovodnikov Akademii nauk SSSR (Institute of Semiconductors, AN SSSR)

SUBMITTED: 06Mar64 ENCL: 00

SUB CODE: SS NO REF SOV: 007 OTHER: 001

Card 3/3

L 18249-65 EWT(1)/EWG(k)/T/EWA(h) Pz-6/Peb IJP(c)/AFWL/ASD 17

ACCESSION NR: AP5000658 S/0181/64/006/012/3608/3616

AUTHORS: Pavlov, S. T.; Firsov, Yu. A.

TITLE: Magnetophonon oscillations of the longitudinal thermal emf in semiconductors

SOURCE: Fizika tverdogo tela, v. 6, no. 12, 1964, 3608-3616

TOPIC TAGS: magnetophonon oscillation, thermomagnetic coefficient, kinetic coefficient, electron phonon scattering, relaxation time, Nernst Ettingshausen effect

ABSTRACT: Continuing earlier investigations of the oscillations of longitudinal and transverse magnetoresistance in semiconductors (ZhETF v. 40, 199, 1961; v. 41, 512, 1961; v. 47, 734, 1964. FTT v. 4, 1813, 1962; v. 3, v. 6, 647, 1964; and ZhETF v. 47, 444, 1964) the authors consider the oscillations of longitudinal thermomagnetic kinetic coefficients. It is shown that in a quantizing

Card 1/3

L 18249-65
ACCESSION NR: AP5000658

[illegible] field, the scattering of the electrons [illegible] oscillations of the [illegible] time in the magnetic field [illegible] dependence of the relaxation time on the longitudinal coordinate, which is smooth in the absence of a magnetic field, becomes highly nonmonotonic in the quantizing magnetic field. The [illegible] ns of the coefficient of electr[illegible] of the Nernst-Ettingshausen [illegible] demonstrate that [illegible] experimental [illegible] [illegible] ssions and valuable remarks. [illegible] formulas.

ASSOCIATION: Institut poluprovodnikov AN SSSR Leningrad (Institute

Card 2/3

L 18249-65

ACCESSION NR: AP5000658

of Semiconductors AN SSSR)

SUBMITTED: 27Jun64

ENCL: 00

SUB CODE: SS

NR REF SOV: 011

OTHER: 001

Card 3/3

GUREVICH, V.L.; FIRSOV, Yu.A.

New oscillation mode of the longitudinal magnetoresistance in semiconductors. Zhur. eksp. i teor. fiz. 47 no.2:734-743 Ag '64. (MIRA 17:10)

1. Institut poluprovodnikov AN SSSR.

EWT(l)/EWG(k)/T/EWA(h) Pz-6/Peb

R: AP4043637 S/0056/64/047/

K.dinov, Ye. K.; Firsov, Yu. A.

TITLE: Interband optical transitions in semiconductors with low mobility

SOURCE: Zh. eksper. i teor. fiz., v. 47, no. 8, 1964, 601-614

TOPIC TAGS: electron transition, electron phonon interaction, absorption coefficient, refractive index, polaron, semiconductor, carrier mobility

ABSTRACT: Optical phenomena connected with the transition of electrons from inner shells into low-mobility bands are considered, and their contribution to the dielectric constant is calculated. A diagrammatic technique for the analysis of strong electron-phonon interaction is developed for the calculation of the complex admittance. ... of this contribution makes it possible to evaluate the absorption coefficients and the change in the refractive index, quantities which in turn can be measured experimentally for compari-

Card 1/2

L 14029-65
ACCESSION NR: AP4043637

ion. Change in the complex admittance is related to the change in the dielectric constant and is easier to evaluate. The location of the peak of the absorption curve is found to depend on the [illegible] ... the width of the peak is not related to the width of the [illegible] or to the initial electron band. The [illegible] appearing at low temperatures [illegible] ... refractive index becomes discontinuous at the frequencies corresponding to the peaks. "The authors thank A. I. [illegible] Gurevich, L. I. Korovin, and G. Ye. Pikus for useful [illegible]." Orig. art. has: 5 figures and 28 formulas.

[illegible] Institut poluprovodnikov Akademii nauk SSSR (Institute of Semiconductors, Academy of Sciences SSSR)

SUBMITTED: 19Feb64

ENCL: 00

SUB CODE: OP, SS

NO REF SOV: 003

OTHER: 004

Card 2/2

...temperatures, the equation loses its ...

L 00732-66 EWT(1)/T/EWA(h) IJP(c) AT

ACCESSION NR: AP5022698 UR/0181/65/007/009/2634/2647

46
43
B

AUTHOR: Pavlov, S. T.;[44,55] Firsov, Yu. A.[44,55]

TITLE: Inversion spin interaction of electrons with optical phonons in semiconductors 44,55,21

SOURCE: Fizika tverdogo tela, v. 7, no. 9, 1965, 2634-2647

TOPIC TAGS: spin phonon interaction, electron interaction, phonon, external magnetic field, semiconductor theory

ABSTRACT: A constant homogeneous magnetic field cancels the spin degeneration of the energy levels of the conduction electrons in a crystal. Splitting of the levels is observed in experiments on paramagnetic resonance in the conduction electrons. Non-quantizing magnetic fields are used in these experiments. Recent studies have shown that splitting of electron levels in strong quantizing magnetic fields, which is caused by cancellation of Kramers degeneration, may also be accompanied by galvanomagnetic and thermomagnetic effects. In particular, spin splitting of Landau levels is reflected in the Shubnikov-de Haas effect. Elimination of spin degeneration also causes complex magnetophonon oscillations in the semiconductor. Several researchers have observed an additional oscillation on the curve for

L 00732-66 3

ACCESSION NR: AP5022698

longitudinal magnetoresistance. This extra oscillation is due to a transition between spin sublevels of the zero Landau level with absorption of an optical phonon. However, there has been no attempt to examine the interaction of electrons with optical phonons, which is responsible for transitions with spin inversion. The authors construct a theory of this type of interaction for semiconductors with a simple zone (non-degenerate and with a minimum in the center of the first Brillouin zone). The effective mass method is successively applied to the problem of interaction of electrons with lattice vibrations with consideration given to spin-orbital binding and the effect of the external magnetic field, which may be a quantizing field. It is shown that only the short-range part of the interaction is responsible for transitions with spin inversion. The form of the operator for the interaction shows that optical phonons may have a considerable effect on spin-lattice relaxation of conduction electrons and may cause additional magnetophonon oscillations of kinetic coefficients in semiconductors in a quantizing magnetic field. The interaction is calculated for InSb. The theory is applicable to crystals both with and without a center of symmetry. Orig. art. has: 73 formulas.

ASSOCIATION: Institut poluprovodnikov AN SSSR, Leningrad (Institute of Semiconductors, AN SSSR) 44,55

SUBMITTED: 06Mar65 ENCL: 00 SUB CODE: SS, NP

NO REF SOV: 014 OTHER: 012

Card 2/2

L 00967-66 EWT(1) IJP(c) UR/0056/65/048/006/1565/1571

ACCESSION NR: AP5016547 38 37

AUTHOR: Pavlov, S. T.; Parfen'yev, R. V.; Firsov, Yu. A.; Shalyt, S. S. B

TITLE: The effect of electron spin on the quantum oscillations of the galvanomagnetic coefficients of n-type InSb 21

SOURCE: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 48, no. 6, 1965, 1565-1571

TOPIC TAGS: indium antimonide, quantum oscillation, Hall coefficient, magnetoresistance, electron spin effect, quantizing magnetic field

ABSTRACT: The authors investigated the galvanomagnetic properties of single crystals of n-type InSb in an electromagnet that produced a constant field up to 30 kOe at T = 1.4K. The investigation showed that in the region of the magnetic field where the transverse magnetoresistance curve exhibits the zeroth maximum an oscillation of the Hall coefficient is also observed, and that this oscillation has a much greater amplitude than the oscillation of the same coefficient near the Landau levels with higher quantum numbers. Some questions connected with the effect of a strong quantizing magnetic field on the energy spectrum, and the conditions of the electron scattering in an n-type InSb crystal, are considered in connection with the experimental results. Orig. art. has: 7 formulas and 2 figures.

Card 1/2

L 00967-66

ACCESSION NR: AP5016547

ASSOCIATION: Institut poluprovodnikov Akademii nauk SSSR (Institute of Semiconductors, Academy of Sciences, SSSR)

SUBMITTED: 06Jan65 ENCL: 00 SUB CODE: SS

NR REF SOV: 006 OTHER: 002

Card 2/2

PAVLOV, S.T.; FIRSOV, Yu.A.

Spin-inverting electron interaction with optical phonons in semiconductors. Fiz. tver. tela 7 no.9:2634-2647 S '65. (MIRA 18:10)

1. Institut poluprovodnikov AN SSSR, Leningrad.

KUDINOV, Ye.K.; FIRSOV, Yu.A.

Stochastic aspects of low mobility theory. Zhur. eksp. i teor. fiz. 49 no.3:867-884 S '65. (MIRA 18:10)

1. Institut poluprovodnikov AN SSSR.

L 12082-66 EWT(d)/EWT(l)/T/EWA(m)-2 IJP(c) AT

ACC NR: AP5024709 SOURCE CODE: UR/0056/65/049/003/0867/0884

61
58
B

AUTHORS: Kudinov, Ye. K; Firsov, Yu. A.

44,55 44,55

ORG: Institute of Semiconductors, Academy of Sciences SSSR (Institut poluprovodnikov Akademii nauk SSSR)

44,55

TITLE: Stochastic aspects of low mobility theory

SOURCE: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 49, no. 3, 1965, 867-884

TOPIC TAGS: electron mobility, electric conductivity, polaron, Boltzmann distribution, Markov process

ABSTRACT: A new method for calculating the electric conductivity is formulated in the Wannier (site) representation. An equation similar to the Boltzmann equation and describing electron motion in the space of lattice sites is derived by using the Kubo formula. The case of a small-radius polaron is analyzed by way of an example. It is shown that in this case the motion of an electron in the lattice can be regarded as comprising non-Markoffian random jumps between lattice sites. Under certain conditions this random walk process becomes Markoffian and the problem reduces to the calculation of the site-jump probabilities per unit time. It is claimed that the method provides a deeper

APPROVED FOR RELEASE: 06/13/2000 CIA-RDP86-00513R000413220018-0"